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PANASONIC CT-2022HBF SERVICE MANUAL

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ORDER NO. MTNC020827A1
B1

Service Manual

Color Television

Simplified

Simplified Manual (NA7D)

Panasonic

Models	Chassis
CT-2022HBF	**AP395**
CT-2022HBCF	**AP395**

This simplified service manual is issued to **add** the models of the **NA7D** family listed above to main manual order No. MTNC010734C1 (CT-2022HE). Included in this simplified service manual are unique characteristics and a complete parts list. Please file and use together with the main service manual order No. MTNC010734C1 (CT-2022HE) and related manuals.

"**WARNING!** This service manual is designed for experienced repair technicians only and is not designed for use by the general public. It does not contain warnings or cautions to advise non-technical individuals of potential dangers in attempting to service a product. **Products powered by electricity should be serviced or repaired only by experienced professional technicians.** Any attempt to service or repair the product or products dealt with in this service manual by anyone else could result in serious injury or death."

The service technician is required to read and follow the "**Safety Precautions**" and "**Important Safety Notice**" in this Manual.

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Important safety notice

Special components are used in this television set which are important for safety. These parts are identified on the schematic diagram by the symbol ⚠ and printed in **BOLD TYPE** on the replacement part list. It is essential that these critical parts are replaced with the manufacturer's specified replacement part to prevent X-ray radiation, shock, fire or other hazards. Do not modify the original design without the manufacturer's permission.

Safety precautions

General guidelines

An **isolation transformer** should always be used during the servicing of a Receiver whose chassis is not isolated from AC power line. Use a transformer of adequate power rating as this protects the technician from accidents resulting in personal injury from electrical shocks. It will also protect the Receiver from being damaged by accidental shorting that may occur during servicing.

When servicing, observe the original lead dress, especially in the high voltage circuit. Replace all damaged parts (also parts that show signs of overheating.)

Always replace protective devices, such as fishpaper, isolation resistors and capacitors, and shields after servicing the Receiver. Use only manufacturer's recommended rating for fuses, circuits breakers, etc.

High potentials are present when this receiver is operating. Operation of the receiver without the rear cover introduces danger for electrical shock. Servicing should not be performed by anyone who is not thoroughly familiar with the necessary precautions when servicing high-voltage equipment.

Extreme care should be practiced when **handling the picture tube**. Rough handling may cause it to implode due to atmospheric pressure. (14.7 lbs per sq. in.). Do not nick or scratch the glass or subject it to any undue pressure. When handling, use safety goggles and heavy gloves for protection. **Discharge the picture tube** by shorting the anode to chassis ground (not to the cabinet or to other mounting hardware). When discharging connect cold ground (i.e. dag ground lead) to the anode with a well insulated wire or use a grounding probe.

Avoid prolonged exposure at close range to unshielded areas of the picture tube to prevent exposure to X-ray radiation.

The **test picture tube** used for servicing the chassis at the bench should incorporate safety glass and magnetic shielding. The safety glass provide shielding for the tube viewing area against X-ray radiation as well as implosion. The magnetic shield limits the X-ray radiation around the bell of the picture tube in addition to the restricting magnetic effects. When using a picture tube test jig for service, ensure that the jig is capable of handling **50kV** without causing X-ray radiation.

Before returning a serviced receiver to the owner, the service technician must thoroughly test the unit to ensure that is completely safe to operate. **Do not use a line isolation transformer when testing.**

Leakage current cold check

Unplug the AC cord and connect a jumper between the two plug prongs.

Measure the resistance between the jumpered AC plug and expose metallic parts such as screwheads, antenna terminals, control shafts, etc. If the exposed metallic part has a return path to the chassis, the reading should be between 240kΩ and 5.2MΩ. If the exposed metallic part does not have a return path to the chassis, the reading should be infinite.

Leakage current hot check (Fig. 1)

Plug the AC cord directly into the AC outlet. Do not use an isolation transformer during the check.

Connect a 1.5kΩ 10 watt resistor in parallel with a 0.15μF capacitor between an exposed metallic part and ground. Use earth ground, for example a water pipe.

Using a DVM with a 1000 ohms/volt sensitivity or higher, measure the AC potential across the resistor.

Repeat the procedure and measure the voltage present with all other exposed metallic parts.

Verify that any potential does not exceed 0.75 volt RMS. A leakage current tester (such a Simpson Model 229, Sencore Model PR57 or equivalent) may be used in the above procedure, in which case any current measure must not exceed 0.5 milliamp. If any measurement is out of the specified limits, there is a possibility of a shock hazard and the Receiver must be repaired and rechecked before it is returned to the customer.

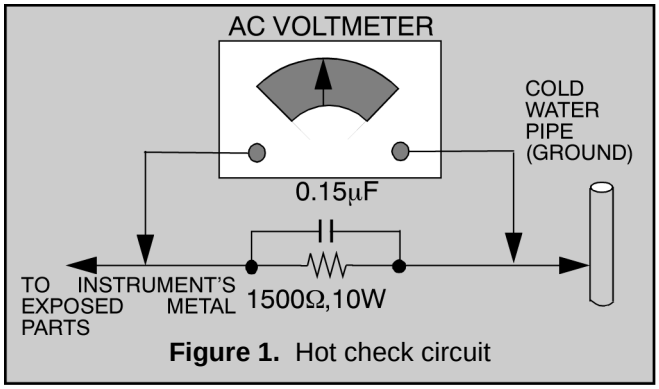


Figure 1. Hot check circuit

X-ray radiation

WARNING: The potential source of X-ray radiation in the receiver is in the high voltage section and the picture tube. Refer to "X-Ray protection circuit check & adjustments" on page 6 to confirm HHS voltage.

High voltage (CRT anode)

Set the **brightness, picture, sharpness** and **color** controls to minimum (to obtain dark image). Measure the High Voltage. The high voltage should be **27.70kV ± 1.25kV**. If the upper limit is out of tolerance, immediate service and correction is required.

Note: *It is important to use an accurate, calibrated high voltage meter.*

About lead free solder (PbF)

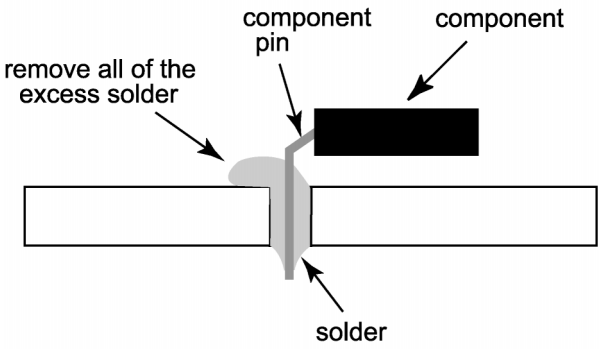
Note: Lead is listed as (Pb) in the periodic table of elements.
In the information below, Pb will refer to Lead solder, and PbF will refer to Lead Free Solder.
The Lead Free Solder used in our manufacturing process and discussed below is (Sn+Ag+Cu).
That is Tin (Sn), Silver (Ag) and copper (Cu) although other types are available.

This model uses Pb Free solder in it's manufacture due to environmental conservation issues. For service and repair work, we'd suggest the use of Pb free solder as well, although Pb solder may be used.

PCBs manufactured using lead free solder will have the "PbF" or a leaf symbol PbF stamped on the back of PCB.

Caution

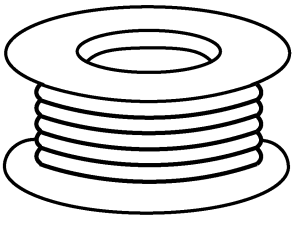
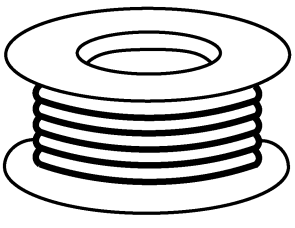
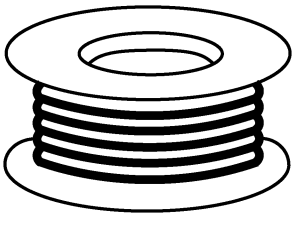
- Pb free solder has a higher melting point than standard solder. Typically the melting point is 50 ~ 70 °F (30 ~ 40 °C) higher. Please use a high temperature soldering iron and set it to 700 ± 20 °F (370 ± 10 °C).
- Pb free solder will tend to splash when heated too high (about 1100 °F or 600 °C). If you must use Pb solder, please completely remove all of the Pb free solder on the pins or solder area before applying Pb solder. If this is not practical, be sure to heat the Pb free solder until it melts, before applying Pb solder.
- After applying PbF solder to double layered boards, please check the component side for excess solder which may flow onto the opposite side. (see figure below)



slice view

Suggested Pb free solder

There are several kinds of Pb free solder available for purchase. This product uses Sn+Ag+Cu (tin, silver, copper) solder. However, Sn+Cu (tin, copper), Sn+Zn+Bi (tin, zinc, bismuth) solder can also be used.

0.3mm X 100g	0.6mm X 100g	1.0mm X 100g
		

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Service notes

Note: *Some components may be affixed with glue. Be careful not to break or damage foil under the component or at the pins of the ICs when removing. Usually applying heat to the component for a short time while twisting with tweezers will break the component loose.*

Leadless chip component

(surface mount)

Chip components must be replaced with identical chips due to critical foil track spacing. There are no holes in the board to mount standard transistors or diodes. Some chips capacitor or resistor board solder pads may have holes through the board, however the hole diameter limits standard resistor replacement to 1/8 watt. Standard capacitor may also be limited for the same reason. It is recommended that identical components be used.

Chip resistor have a three digit numerical resistance code - 1st and 2nd significant digits and a multiplier. Example: 162 = 1600 or 1.6kΩ resistor, 0 = 0Ω (jumper).

Chip capacitors generally do not have the value indicated on the capacitor. The color of the component indicates the general range of the capacitance.

Chip transistors are identified by a two letter code. The first letter indicates the type and the second letter, the grade of transistor.

Chip diodes have a two letter identification code as per the code chart and are a dual diode pack with either common anode or common cathode. Check the parts list for correct diode number.

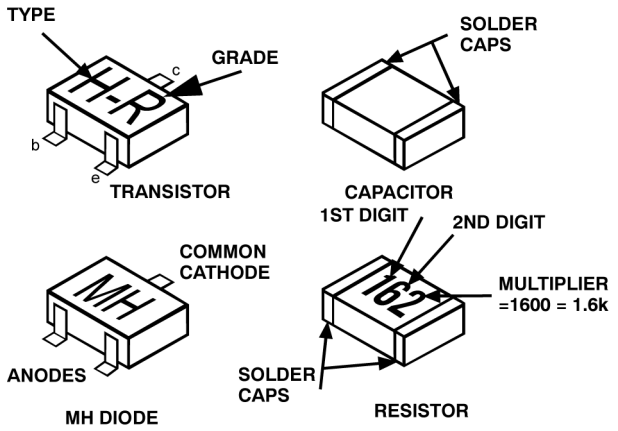
Component removal

1. Use solder wick to remove solder from component end caps or terminal.
2. Without pulling up, carefully twist the component with tweezers to break the adhesive.
3. Do not reuse removed leadless or chip components since they are subject to stress fracture during removal.

Chip component installation

1. Put a small amount of solder on the board soldering pads.
2. Hold the chip component against the soldering pads with tweezers or with a miniature alligator clip and apply heat to the pad area with a 30 watt iron until solder flows. Do not apply heat for more than 3 seconds.

Chip components

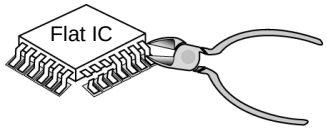


How to replace flat-IC

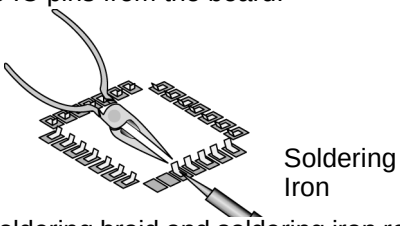
- Required Tools -

- Soldering iron
- Needle nose pliers
- Wire cutters (sharp & small)
- De-solder braids
- Magnifier

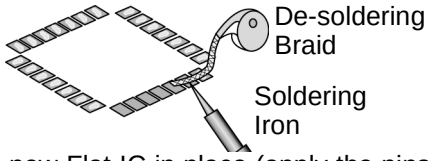
1. Cut the pins of a defective IC with wire cutters. Remove IC from board. If IC is glued to the board, heat the IC and release the IC. See Note above.



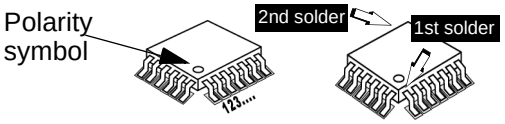
2. Using soldering iron and needle nose pliers remove the IC pins from the board.



3. Using de-soldering braid and soldering iron remove solder from affected are on board (pads).

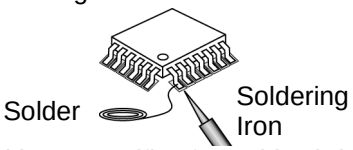


4. Position the new Flat-IC in place (apply the pins of the Flat-IC to the soldering pads where the pins need to be soldered). Determine the positions of the soldering pads and pins by correctly aligning the polarity symbol. Solder pin #1 first, align the IC.

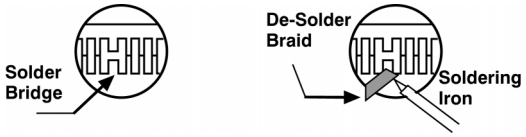


Solder the pin opposite to pin #1. This will assist positioning the IC.

5. Solder all pins to the soldering pads using a fine tipped soldering iron.



6. Check with a magnifier for solder bridge between the pins or for dry joint between pins and soldering pads. To remove a solder bridge, use a de-solder braid as shown in the figure below.



IMPORTANT: To protect against possible damage to the solid state devices due to arcing or static discharge, make certain that all ground wires and CRT DAG wire are securely connected.

CAUTION: The power supply circuit is above earth ground and the chassis cannot be polarized. Use an isolation transformer when servicing the Receiver to avoid damage to the test equipment or to the chassis. Connect the test equipment to the proper ground (⏚) or (⏚) when servicing, or incorrect voltages will be measured.

WARNING: This Receiver has been designed to meet or exceed applicable safety and X-ray radiation protection as specified by government agencies and independent testing laboratories.

To maintain original product safety design standards relative to x-ray radiation and shock and fire hazard, parts indicated with the symbol ⚠ on the schematic must be replaced with identical parts. Order parts from the manufacturer's parts center using the parts numbers shown in this service manual, or provide the chassis number and the part reference number.

For optimum performance and reliability, all other parts should be replaced with components of identical specification.

X-Ray protection circuit check & adjustments

This test must be performed as final check before the Receiver is returned to the customer. If voltages are out of tolerance, immediate service and correction is required to insure safe operation and to prevent the possibility of premature component failure.

Equipment:

1. Isolation transformer.
2. High voltage meter.
3. Short jumper.
4. Jumper diode (same as D823, PN S3L60P154004). diode should be rated a minimum of 150V.

Procedure:

1. Connect the receiver to an isolation transformer. turn receiver ON.
2. Apply a monoscope pattern.
3. In service mode (see service mode section in this manual) select register C0B.
4. Measure TP5 (located near the tuner). Compare the measured value to the left column of the table below. Set C0B with value from the right column corresponding to the measured level at TP5. Example, if the measured level at TP5 is 1.03V, set C0B to 03.

TP5 MEASUREMENT	SET C0B TO (HEX)
0 ~ 0.93V	00
0.93 ~ 0.97V	01
0.97 ~ 1.01V	02
1.01 ~ 1.05V	03
1.05 ~ 1.09V	04
1.09 ~ 1.13V	05
1.13 ~ 1.17V	06
1.17 ~ 1.21V	07

5. Exit service mode and shut it OFF.
6. Connect the short jumper between TPD16 and TPD17.
7. Connect the jumper diode between TPD14 and TPD15 (cathode connected to TPD14, anode connected to TPD15).
8. Apply 75VAC to the input of the isolation transformer.
9. Turn receiver ON.
10. Set PICTURE and BRIGHTNESS to minimum.
11. Slowly increase the voltage at the input of the isolation transformer and confirm HHS voltage measure **34.0KV** when the receiver starts to go out of sync.
12. Turn receiver OFF and remove jumper & diode.

Receiver feature table

FEATURE/MODEL	CT-2022HBF/HBCF
Chassis	AP395
Tuning system	40K - GEN II
Number of channels	181
Closed Caption	X
V-Chip	X
75 Ω input	X
Remote TV Only	EUR501450
CRT SUPPLIER	BMCC
Comb filter	2 Dig
V/A norm (X=BOTH)	V
AUTO ON	X
AI Sound (always on)	X
Built-in audio power	1.5W
Number of speakers	1
A/V in (rear/front)	(0/1)
Smart plug interfase	SMART PLUG
Dimensions mm (HxWxD) in	516x492x462 20.28x19.33x18.15
Weight (kg/lbs)	19.7/43.34
Power source (V/Hz)	120/60
Anode voltage	27.7kV±1.25kV

Table 1. **Receiver features**

Board description

BOARD	CT-2022HBF/HBCF	DESCRIPTION
A-Board TNP2AH024	DZ	MAIN BOARD
C-Board TNP2AA075	AH	CRT BOARD
DI-Board TNP2AA094	NIL	SMART PLUG

Table 1. **Receiver features**

Specifications are subject to change without notice or obligation.
Dimensions and weights are approximate.

Note: *When ordering a replacement board, append an "S" to the board number.*
Example: to order the A-Board for CT-2022HBF, the replacement board is ***TNP2AH024DZS.***

Location of controls (remote)

POWER button
Press to turn ON and OFF.
MUTE button
Press to mute sound. A second press resumes sound. Press also to access and delete closed caption display.
TV/VIDEO button
Press to select TV or Video input.
VOLUME buttons
Press to adjust TV sound level. Use with channel buttons to navigate in menus.
CHANNEL buttons
Press to select channels. Use with volume buttons to navigate in menus.
ACTION button
Press to display main menu and access or exit on screen features and adjustment menus.
Keypad buttons
Press desired channel number to randomly access any channel.
R-TUNE (rapid tune) button.
Press to switch to the previous channel.
RECALL button
Press to display time, status of sleep timer, channel, video mode and channel caption (station identifier).

EUR501450

Figure 2. **Location of controls (remote)**.

Identification of components

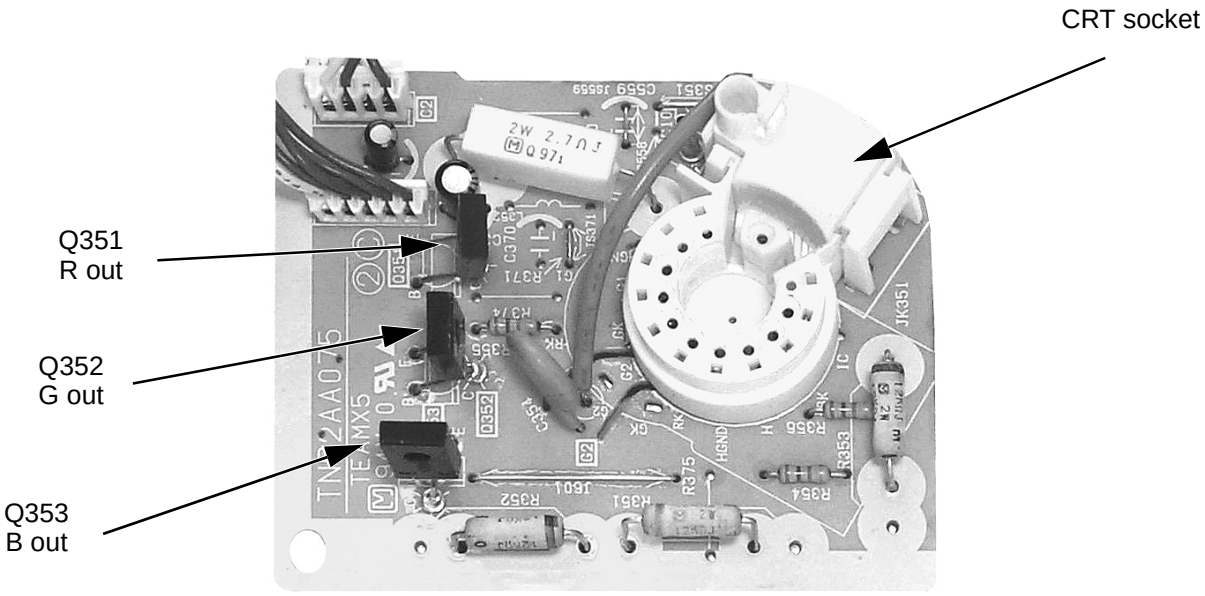


Figure 3. C-Board components location

Identification of components

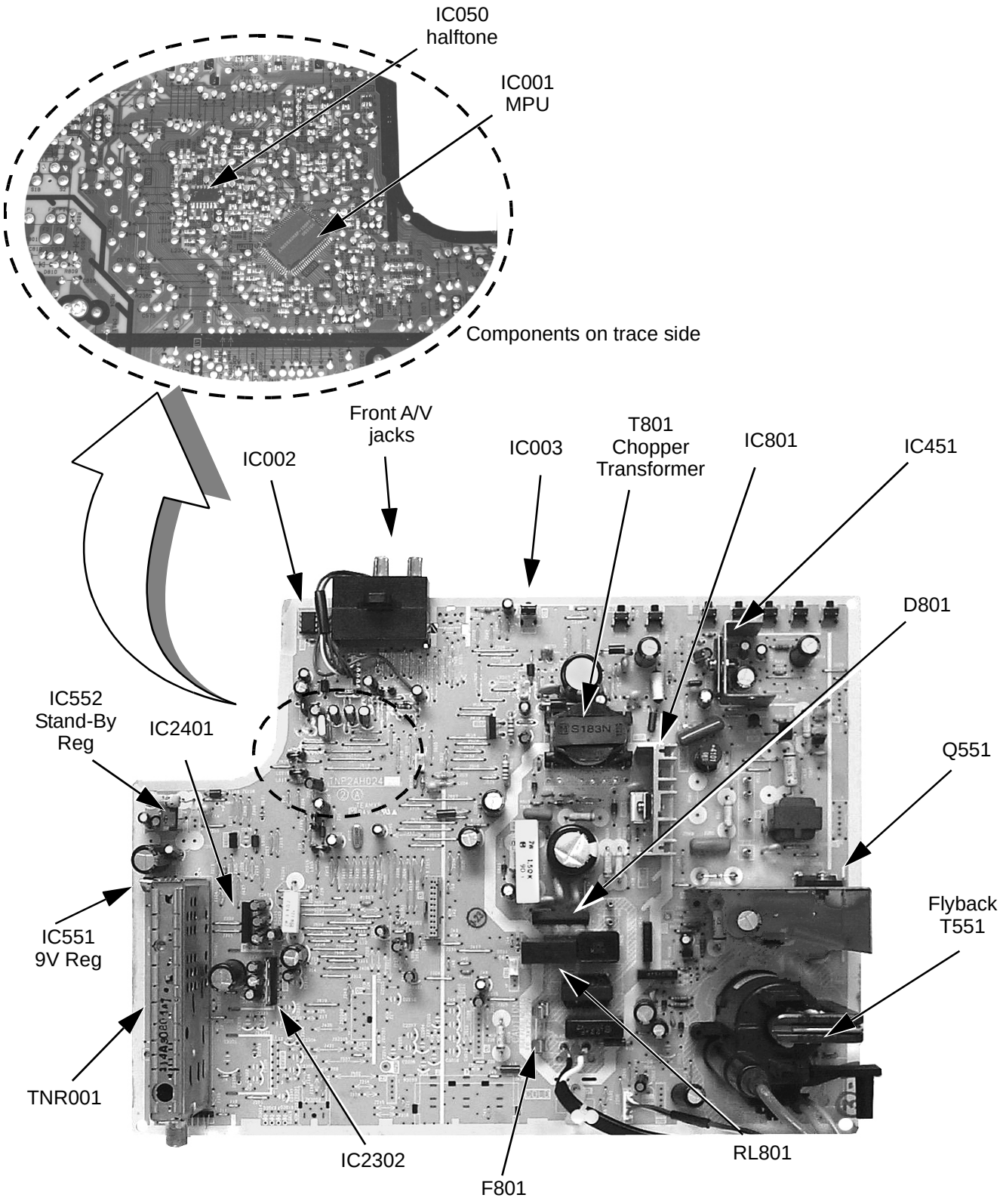


Figure 4. A-Board location of components

Audio signal path block diagram

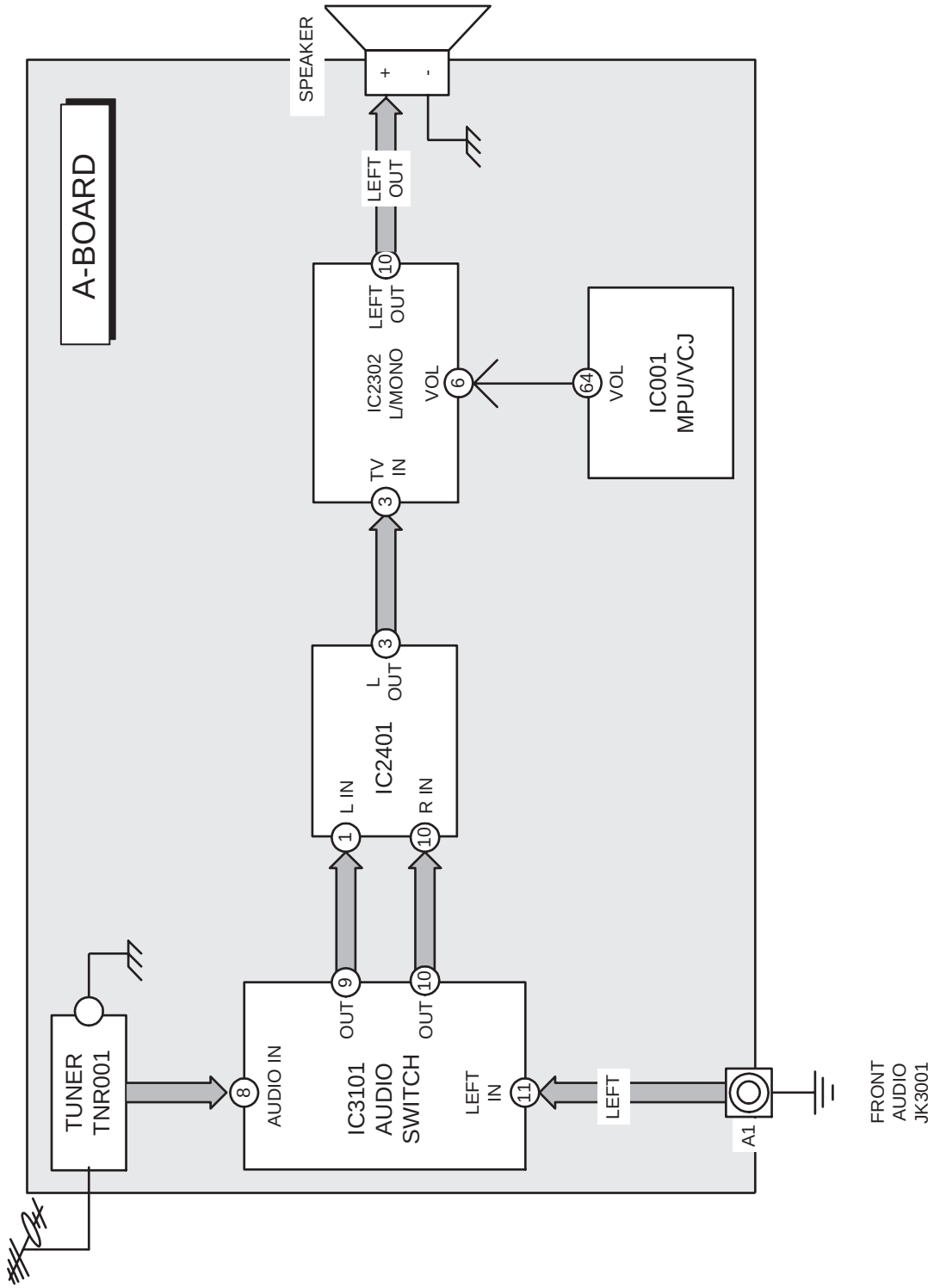


Figure 5. Audio signal block diagram

Video signal path block diagram

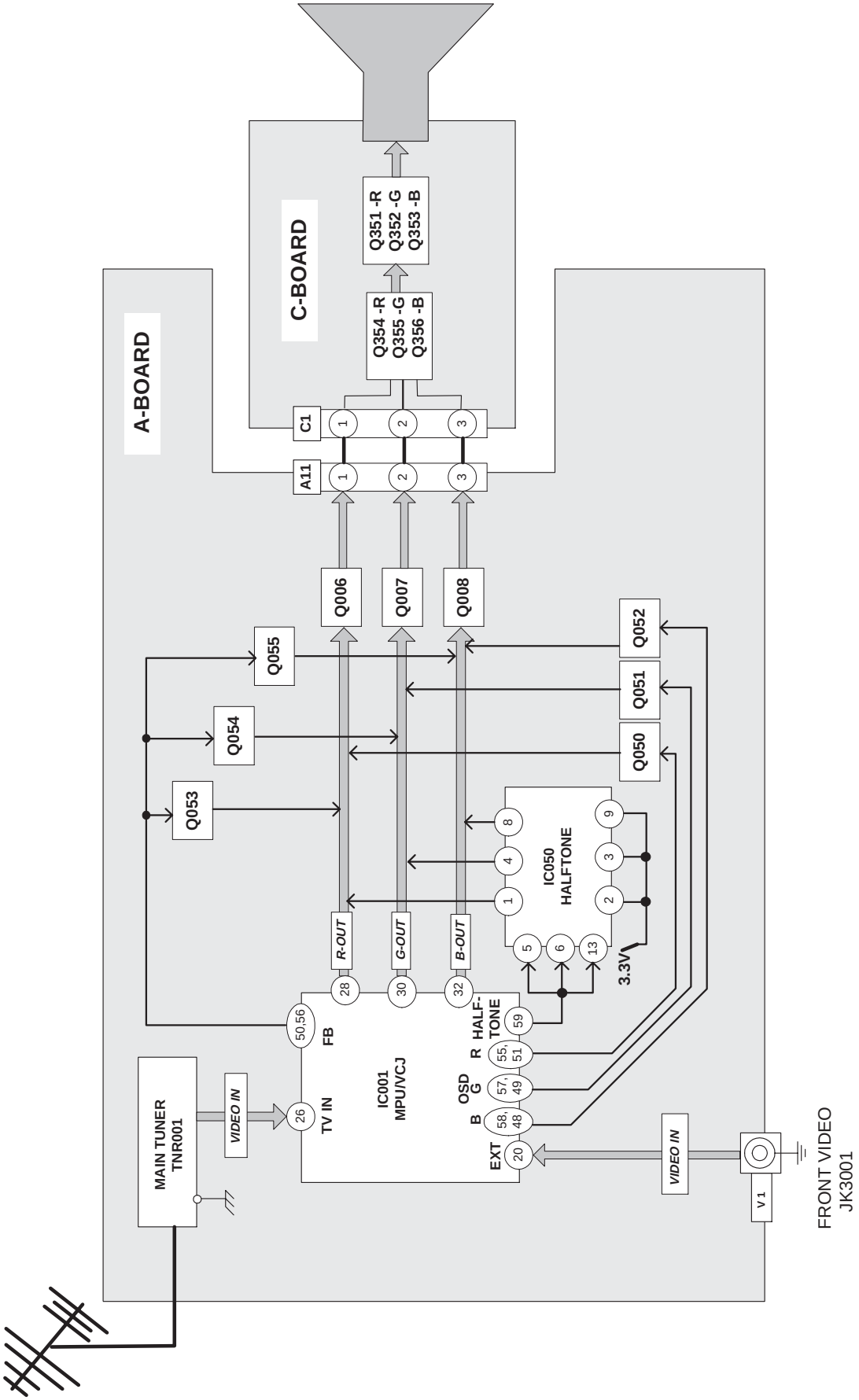


Figure 6. Video signal block diagram

REPLACEMENT PARTS LIST

Models: CT-2022HBF, CT-2022HBCF.

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
	CAPACITORS	
C001	**TCJ2VB1H103K**	**CAP,C .01UF-K-50V**
C002	TCJ2VB1H471K	CAP,C 470PF-K-50V
C003	ECA1HM4R7B	CAP,E 4.7UF-50V
C004	TCJ2VC1H150J	CAP,C 15PF-J-50V
C005	TCJ2VC1H150J	CAP,C 15PF-J-50V
C008	TCJ2VF1H104Z	CAP,C .1UF-Z-50V
C009	ECA1CM470B	CAP,E 47UF/16V
C010	TCJ2VF1H104Z	CAP,C .1UF-Z-50V
C011	ECA1CM101B	CAP,E 100UF/16V
C015	ECJ2VB1C224K	CAP,C .22UF-K-16V
C016	TCJ2VC1H101J	CAP,C 100PF-J-50V
C017	TCJ2VB1C104K	CAP,C .1UF-K-16V
C018	TCJ2VC1H151J	CAP,C 150PF-J-50V
C020	TCJ2VB1C104K	CAP,C .1UF-K-16V
C022	TCJ2VC1H101J	CAP,C 100PF-J-50V
C023	TCJ2VC1H151J	CAP,C 150PF-J-50V
C024	ECA1CM470B	CAP,E 47UF/16V
C025	TCJ2VB1C104K	CAP,C .1UF-K-16V
C026	TCJ2VB1C104K	CAP,C .1UF-K-16V
C027	TCJ2VF1H104Z	CAP,C .1UF-Z-50V
C028	TCJ2VB1C104K	CAP,C .1UF-K-16V
C029	ECQB1H333JF3	CAP,P .033UF-J-50V
C031	ECA1HMR22B	CAP,E .22UF-50V
C032	ECA1VM470B	CAP,E 47UF/35V
C033	TCJ2VC1H390J	CAP,C 39PF-J-50V
C034	TCJ2VB1H103K	CAP,C .01UF-K-50V
C035	ECA1HM010B	CAP,E 1UF-50V
C036	TCJ2VB1H103K	CAP,C .01UF-K-50V
C037	ECA1HM0R1B	CAP,E 0.1UF/50V
C038	ECA1VM470B	CAP,E 47UF/35V
C040	ECA1CM470B	CAP,E 47UF/16V
C041	ECA1HM2R2B	CAP,E 2.2UF-50V
C042	TCJ2VF1H104Z	CAP,C .1UF-Z-50V
C043	ECA1CM470B	CAP,E 47UF/16V
C044	TCJ2VC1H471J	CAP,C 470PF-J-50V
C045	ECA1HM0R1B	CAP,E 0.1UF/50V
C046	TCJ2VB1C104K	CAP,C .1UF-K-16V
C047	TCJ2VC1H220J	CAP,C 22PF-J-50V
C048	TCJ2VC1H220J	CAP,C 22PF-J-50V
C050	ECA1CM101B	CAP,E 100UF/16V
C051	TCJ2VF1H104Z	CAP,C .1UF-Z-50V
C055	TCJ2VC1H560J	CAP,C 56PF-J-50V
C103	ECA0JM331B	CAP,E 330UF-6.3V
C104	TCJ2VB1H103K	CAP,C .01UF-K-50V
C105	ECA0JM101B	CAP,E 100UF-6.3V
C201	TCJ2YC1H222J	CAP,C .022UF-J-50V
C350	ECA1CM101B	CAP,E 100UF/16V
C351	TCJ2VB1H391K	CAP,C 390PF-K-50V
C352	TCJ2VB1H391K	CAP,C 390PF-K-50V
C353	TCJ2VB1H471K	CAP,C 470PF-K-50V

REF NO.	PART NO.	DESCRIPTION
C354	ECKW3D102KBN	CAP,C .001UF-K-2KVDC
C357	EEANA1E1R0B	CAP,E 1.0UF-25V
C361	TCJ2VC1H151J	CAP,C 150PF-J-50V
C362	TCJ2VC1H151J	CAP,C 150PF-J-50V
C363	TCJ2VC1H151J	CAP,C 150PF-J-50V
C451	ECA1CHG470B	CAP,E 47UF-16V
C452	ECSF1EE105VB	CAP,E 1.0UF-25V
C453	ECEA1HFS4R7B	CAP,E 4.7UF-50V
C454	ECA1EM102E	CAP,E 1000UF-25V
C455	ECA1EHG101B	CAP,E 100UF-25V
C456	ECQB1H103JF3	CAP,P .01UF-J-50V
C459	ECA1VHG471E	CAP,E 470UF-35V
C462	ECA1HM4R7B	CAP,E 4.7UF-50V
C502	TCJ2VC1H471J	CAP,C 470PF-J-50V
C503	TCJ2VB1C104K	CAP,C .1UF-K-16V
C504	TCJ2VB1C104K	CAP,C .1UF-K-16V
C510	ECCR2H100D5	CAP,C 10PF-D-500V
C511	ECKR2H821KB5	CAP,C 820PF-K-500V
C512	ECKR2H101KB5	CAP,C 100UF-K-500V
C531	**ECA1HM220B**	**CAP,E 22UF-50V**
C551	**ECA1VM331B**	**CAP,E 330UF-35V**
C554	ECKR2H561KB5	CAP,C 560PF-K-500V
C555	**ECA2EM220E**	**CAP,E 22UF-250V**
C556	**ECA1CM471B**	**CAP,E 470UF-16V**
C557	ECKR2H222KB5	CAP,C 2200PF-K-500V
C560	ECEA1HN010UB	CAP,E 1UF/50V
C561	ECKR2H561KB5	CAP,C 560PF-K-500V
C563	**ECWH12H362JS**	**CAP,P 3600PF-J-1250VDC**
C564	**ECWH12H472JS**	**CAP,P .0047UF-J-1.2KV**
C565	**ECKW3D102JBR**	**CAP,C 1000PF-J-2KV**
C566	**ECKW3D181JBP**	**CAP,C 180PF-J-2KV**
C568	**ECQM4473JZW**	**CAP,P .047UF-J-400V**
C569	**ECWF2474JBB**	**CAP,P .47UF-J-200V**
C570	ECA1CM222E	CAP,E 2200UF-16V
C571	ECA1HM220B	CAP,E 22UF-50V
C572	ECA1HM100B	CAP,E 10UF/50V
C573	ECA1CM101B	CAP,E 100UF/16V
C575	ECA0JM222B	CAP,E 2200UF-6.3V
C577	ECA1CM101B	CAP,E 100UF/16V
C578	ECA0JM332B	CAP,E 3300PF-6.3V
C579	TCJ2VC1H100D	CAP,C 10PF-J-50V
C582	ECKR1H471KB5	CAP,C 470PK-K-50V
C583	ECQB1H103JF3	CAP,E .010UF-J-50V
C605	TCJ2VB1H103K	CAP,C .01UF-K-50V
C606	ECA0JM221B	CAP,E 220UF-6.3V
C801	**ECKWAE472ZED**	**CAP,C 4700PF-Z-500V**
C802	**ECKWAE472ZED**	**CAP,C 4700PF-Z-500V**
C803	**ECKWAE472ZED**	**CAP,C 4700PF-Z-500V**
C805	**EC0S2DA221BB**	**CAP,E 220UF/200V**
C806	ECQM4103KZW	CAP,P .01UF-K-400V
C807	ECKR3A821KBP	CAP,C 820PF-K-1KV

REPLACEMENT PARTS LIST

Models: CT-2022HBF, CT-2022HBCF.

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
C808	ECA1VM101B	CAP,E 100UF-35V
C809	ECKR1H101KB5	CAP,C 100PF-K-50V
C810	ECKR1H471KB5	CAP,C 470PF-K-50V
C812	**ECQU2A224MVA**	**CAP,P .22UF-M-250VAC**
C813	**ECQU2A153MVA**	**CAP,P .015UF-M-250VAC**
C814	**ECQU2A153MVA**	**CAP,P .015UF-M-250VAC**
C820	ECA1CM101B	CAP,E 100UF/16V
C821	TCJ2VB1H103K	CAP,C .01UF-K-50V
C822	ECKR3A221KBP	CAP,C 220PF-K-1KV
C823	**ECA1HM471B**	**CAP,E 470UF-50V**
C824	ECKR3A102KBP	CAP,C 1000PF-K-1KV
C825	**EEUMG2C221S**	**CAP,E 220UF-160V**
C826	ECKR3A471KBP	CAP,C 470PF-K-1KV
C827	ECA1CM221B	CAP,E 10UF-16V
C828	ECA160V33UE	CAP,E 33UF/160V
C1001	**ECA1CM471E**	**CAP,E 470UF-16V**
C1002	TACCX103T50V	CAP,C .01UF/50V
C1003	ECA0JM101B	CAP,E 100UF-6.3V
C1004	TACCX103T50V	CAP,C .01UF/50V
C1005	TACCX103T50V	CAP,C .01UF/50V
C2215	EEANA1E100B	CAP,E 10UF-25V
C2311	ECA1VM102E	CAP,E 1000UF-35V
C2312	ECEA1HN010UB	CAP,E 1UF/50V
C2313	ECA1EM101B	CAP,E 100UF-25V
C2314	ECA1CM100B	CAP,E 10UF-16V
C2317	ECA1CM102B	CAP,E 1000UF/16V
C2330	ECA1CM100B	CAP,E 10UF-16V
C2350	ECA1HM4R7B	CAP,E 4.7UF-50V
C2401	ECA1EM100B	CAP,E 10UF-25V
C2402	ECA1EM100B	CAP,E 10UF-25V
C2403	ECA1EM4R7B	CAP,E 4.7UF/25V
C2404	ECA1CM221B	CAP,E 10UF-16V
C3001	ECA1HM0R1B	CAP,E 0.1UF/50V
C3015	ECA1HM010B	CAP,E 1UF-50V
C3121	ECA1CM470B	CAP,E 47UF/16V
C3122	TCJ2VB1H103K	CAP,C .01UF-K-50V
	DIODES	
D002	MA165TA5VT	DIODE, SWITCHING
D006	MA4330HTA	DIODE
D052	MA4068MTA	DIODE, ZENER
D053	MA4056MTA	DIODE
D055	MA4056MTA	DIODE
D451	ERA15-01V3	DIODE, RECTIFIER
D452	MA4047MTA	DIODE
D453	MA165TA5VT	DIODE, SWITCHING
D454	MA165TA5VT	DIODE, SWITCHING
D456	MA4047MTA	DIODE
D502	MA4047MTA	DIODE
D531	**AS01V0**	**DIODE**
D551	**D1NL20UV70**	**DIODE**
D554	**AU02V0**	**DIODE**

REF NO.	PART NO.	DESCRIPTION
D558	RS3FS	DIODE
D559	BYD33G-113	DIODE
D561	**AU02V0**	**DIODE**
D571	MA165TA5VT	DIODE, SWITCHING
D606	MA165TA5VT	DIODE, SWITCHING
D607	MA152KTX	DIODE
D608	MA152KTX	DIODE
D609	MA152KTX	DIODE
D801	**D3SBA60-4103**	**DIODE**
D806	**TAP2AA0001**	**PTC 5-OHM**
D808	SARS01V1	DIODE
D809	AG01V0	DIODE
D810	AG01V0	DIODE
D811	AG01V0	DIODE
D812	MA4068MTA	DIODE, ZENER
D820	**MA165TA5VT**	**DIODE, SWITCHING**
D821	MA4047HTA	DIODE
D822	RN1ZLF-B1	DIODE
D823	**S3L60P154004**	**DIODE**
D824	D1NL20UV70	DIODE
D1001	MA4068MTA	DIODE, ZENER
D1002	MA4068MTA	DIODE, ZENER
D1003	MA4068MTA	DIODE, ZENER
D2350	MA4068MTA	DIODE, ZENER
D2351	MA165TA5VT	DIODE, SWITCHING
D2352	MA165TA5VT	DIODE, SWITCHING
D2353	MA165TA5VT	DIODE, SWITCHING
D2354	MA4091MTA	DIODE
D3001	MA3110MTX	DIODE, ZENER
D3017	MA3110MTX	DIODE, ZENER
D3018	MA3110MTX	DIODE, ZENER
D3019	MA3110MTX	DIODE, ZENER
D3020	MA3110MTX	DIODE, ZENER
	FUSES	
F801	**XBA2A00101**	**FUSE 6.3A 125V**
	INTEGRATED CIRCUITS	
IC001	**M65580MAPA01**	**MPU**
IC002	TVR2AJ113S	EEPROM
IC003	RPM7138H5	REMOTE SENSOR
IC005	PQ1R33	3.3V REGULATOR
IC006	MN1280R	RESET
IC050	TC74HC4066AL	HALFTONE
IC451	**LA7837-TV**	**V OUT**
IC551	AN78M09LB	9V REGULATOR
IC552	**AN78M05LB**	**PLUS 5V AVR**
IC553	**AN78M05LB**	**PLUS 5V AVR**
IC801	**STRG5623A**	**VCO (POWER SUPPLY)**
IC1001	TC4066BP	CLONE/MATE MULTIPLEXER
IC2302	AN17800A	AUDIO OUT AMP
IC2401	AN5285K	SOUND AGC
IC3101	TC74HC4066AL	A/V SWITCH

REPLACEMENT PARTS LIST

Models: CT-2022HBF, CT-2022HBCF.

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REF NO.	PART NO.	DESCRIPTION
		COILS
L001	EXCELSA35T	FERRITE BEAD
L003	TLUABTA2R2K	COIL, PEAKING 2.2UH
L004	TLUABTA2R2K	COIL, PEAKING 2.2UH
L005	EXCELDR35V	FERRITE BEAD
L006	EXCELSA24T	FERRITE BEAD
L007	EXCELDR35V	FERRITE BEAD
L009	EXCELSA35V	FERRITE BEAD
L010	ELESN330JA	COIL, PEAKING 33UH
L011	ELESN330JA	COIL, PEAKING 33UH
L013	EXCELDR35V	FERRITE BEAD
L014	ELESN180KA	COIL, PEAKING 18UH
L015	EXCELSA35V	FERRITE BEAD
L016	EXCELSA35V	FERRITE BEAD
L017	TLUABTA100K	COIL, PEAKING 10UH
L018	TLUABTA150K	COIL, PEAKING 15UH
L019	EXCELDR35V	FERRITE BEAD
L090	EXCELSA24T	FERRITE BEAD
L104	TLUABTA2R2K	COIL, PEAKING 2.2UH
L108	EXCELSA35V	FERRITE BEAD
L245	EXCELSA35V	FERRITE BEAD
L250	EXCELSA35V	FERRITE BEAD
L306	TLUABTA2R2K	COIL, PEAKING 2.2UH
L325	EXCELSA35V	FERRITE BEAD
L403	TLUABTA2R2K	COIL, PEAKING 2.2UH
L416	EXCELSA39V	FERRITE BEAD
L551	**ELH5L4101**	**COIL**
L801	**ELF15N013A**	**LINE FILTER**
L802	ELEIE680KA	COIL, PEAKING 68UH
L803	TALL08T680KA	COIL
L2305	EXCELSA35V	FERRITE BEAD
L2308	EXCELSA35V	FERRITE BEAD
L2350	ELESN4R7JA	COIL, PEAKING 4.7UH
		TRANSISTORS
Q001	2SD601ARTX	TRANSISTOR
Q006	2SB709ARTX	TRANSISTOR
Q007	2SB709ARTX	TRANSISTOR
Q008	2SB709ARTX	TRANSISTOR
Q009	2SC1473A	TRANSISTOR
Q050	2SB709ARTX	TRANSISTOR
Q051	2SB709ARTX	TRANSISTOR
Q052	2SB709ARTX	TRANSISTOR
Q053	2SD601ARTX	TRANSISTOR
Q054	2SD601ARTX	TRANSISTOR
Q055	2SD601ARTX	TRANSISTOR
Q090	2SB709ARTX	TRANSISTOR
Q092	2SB709ARTX	TRANSISTOR
Q351	2SC3063RL	TRANSISTOR
Q352	2SC3063RL	TRANSISTOR
Q353	2SC3063RL	TRANSISTOR
Q354	2SD601ARTX	TRANSISTOR

REF NO.	PART NO.	DESCRIPTION
Q355	2SD601ARTX	TRANSISTOR
Q356	2SD601ARTX	TRANSISTOR
Q451	2SD601ARTX	TRANSISTOR
Q452	2SD601ARTX	TRANSISTOR
Q453	2SD601ARTX	TRANSISTOR
Q501	2SC1573AH	TRANSISTOR
Q505	2SD601ARTX	TRANSISTOR
Q520	2SD601ARTX	TRANSISTOR
Q551	**2SD2499LBMA2**	**TRANSISTOR**
Q605	2SB709ARTX	TRANSISTOR
Q606	2SD601ARTX	TRANSISTOR
Q820	2SA1767QTA	TRANSISTOR
Q830	2SB1011QRL	TRANSISTOR
Q1001	2SC1685QRSTA	TRANSISTOR
Q1002	2SC1685QRSTA	TRANSISTOR
Q1003	2SC1685QRSTA	TRANSISTOR
Q1004	2SC1685QRSTA	TRANSISTOR
Q1005	2SC1685QRSTA	TRANSISTOR
Q1006	2SC1685QRSTA	TRANSISTOR
Q1007	2SC1685QRSTA	TRANSISTOR
Q2350	2SB709ARTX	TRANSISTOR
Q3191	2SD601ARTX	TRANSISTOR
Q3192	2SD601ARTX	TRANSISTOR
		RELAYS
RL801	**TSEH0005**	**RELAY**
		RESISTORS
R001	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R003	ERJ6GEYJ105V	RES,M 1M-J-1/10W
R004	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R006	ERDS2TJ101T	RES,C 100-J-1/4W
R007	ERJ6GEYJ471V	RES,M 470-J-1/10W
R008	ERJ6GEYJ471V	RES,M 470-J-1/10W
R009	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R010	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R011	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R012	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R013	ERJ6GEYJ202V	RES,M 2K-J-1/10W
R014	ERJ6GEYJ221V	RES,M 220-J-1/10W
R015	ERJ6GEYJ221V	RES,M 220-J-1/10W
R016	ERJ6GEYJ221V	RES,M 220-J-1/10W
R017	ERJ6GEYJ681V	RES,M 680-J-1/10W
R018	ERJ6GEYJ681V	RES,M 680-J-1/10W
R019	ERJ6GEYJ681V	RES,M 680-J-1/10W
R021	ERJ6GEYJ101V	RES,M 100-J-1/10W
R022	ERJ6GEYJ101V	RES,M 100-J-1/10W
R023	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R024	ERJ6GEYJ153V	RES,M 15K-J-1/10W
R028	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R029	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R032	ERJ6ENF1002V	RES,M 10K-F-1/10W
R033	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W

REPLACEMENT PARTS LIST

Models: CT-2022HBF, CT-2022HBCF.

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REF NO.	PART NO.	DESCRIPTION
R034	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R035	ERJ6GEYJ332V	RES,M 3.3K-J-1/10W
R036	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R037	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R038	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R039	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R040	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R041	ERJ6GEYJ153V	RES,M 15K-J-1/10W
R042	ERJ6GEYJ392V	RES,M 3.9K-J-1/10W
R043	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R044	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R045	ERJ6GEYJ101V	RES,M 100-J-1/10W
R046	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R062	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R063	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R064	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R065	ERJ6GEYJ272V	RES,M 2.7K-J-1/10W
R066	ERJ6GEYJ272V	RES,M 2.7K-J-1/10W
R067	ERJ6GEYJ272V	RES,M 2.7K-J-1/10W
R068	ERJ6GEYJ182V	RES,M 1.8K-J-1/10W
R069	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R070	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R071	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R072	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R079	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R081	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R090	ERJ6GEYJ471V	RES,M 470-J-1/10W
R091	ERJ6GEYJ185V	RES,M 1.8MEG-J-1/10W
R092	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R093	ERJ6GEYJ331V	RES,M 330-J-1/10W
R201	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R351	ERG2FJ123H	RES,M 12K-J-2W
R352	ERG2FJ123H	RES,M 12K-J-2W
R353	ERG2FJ123H	RES,M 12K-J-2W
R354	ERDS1TJ272T	RES,C 2.7K-J-1/2W
R355	ERDS1TJ272T	RES,C 2.7K-J-1/2W
R356	ERDS1TJ272T	RES,C 2.7K-J-1/2W
R357	ERJ6ENF4300V	RES,M 430-F-1/10W
R358	ERJ6ENF4300V	RES,M 430-F-1/10W
R359	ERJ6ENF4300V	RES,M 430-F-1/10W
R360	ERJ6ENF7500V	RES,M 750-F-1/10W
R361	ERJ6ENF7500V	RES,M 750-F-1/10W
R362	ERJ6ENF7500V	RES,M 750-F-1/10W
R363	ERJ6GEYJ101V	RES,M 100-J-1/10W
R364	ERJ6GEYJ101V	RES,M 100-J-1/10W
R365	ERJ6GEYJ101V	RES,M 100-J-1/10W
R370	ERDS2TJ224T	RES,C 220K-J-1/4W
R381	ERJ6GEYJ101V	RES,M 100-J-1/10W
R382	ERJ6GEYJ101V	RES,M 100-J-1/10W
R383	ERJ6GEYJ101V	RES,M 100-J-1/10W
R384	ERJ6ENF2701V	RES,M 2.7K-F-1/10W
R385	ERJ6ENF7501V	RES,M 7.5K-F-1/10W
R386	ERJ6ENF1201V	RES,M 1.2K-F-1/10W
R387	ERJ6ENF2701V	RES,M 2.7K-F-1/10W
R388	ERJ6ENF7501V	RES,M 7.5K-F-1/10W
R389	ERJ6ENF1201V	RES,M 1.2K-F-1/10W
R390	ERJ6ENF2701V	RES,M 2.7K-F-1/10W
R391	ERJ6ENF7501V	RES,M 7.5K-F-1/10W
R392	ERJ6ENF1201V	RES,M 1.2K-F-1/10W
R450	ERJ6GEYJ563V	RES,M 56K-J-1/10W
R451	ERDS1FJ1R2P	RES,C 1.2-J-1/2W
R454	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R455	ERJ6GEYJ153V	RES,M 15K-J-1/10W
R456	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R457	ERJ6GEYJ162V	RES,M 1.6K-J-1/10W
R458	ERJ6GEYJ303V	RES,M 30K-J-1/10W
R459	ERJ6GEYJ683V	RES,M 68K-J-1/10W
R460	ERDS2TJ102T	RES,C 1K-J-1/4W
R462	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R463	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R465	ERJ6GEYJ303V	RES,M 30K-J-1/10W
R467	ERJ6GEYJ183V	RES,M 18K-J-1/10W
R468	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R469	ERJ6GEYJ220V	RES,M 22-J-1/10W
R471	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R472	ERJ6GEYJ473V	RES,M 47K-J-1/10W
R475	ERJ6GEYJ471V	RES,M 470-J-1/10W
R502	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R504	ERDS2TJ152T	RES,C 1.5K-J-1/4W
R505	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R506	ERJ6GEYJ333V	RES,M 33K-J-1/10W
R507	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R508	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R510	**ERG3FJ182**	**RES,M 1.8K-J-3W**
R512	ERG2FJ562H	RES,M 5.6K-J-2W
R520	ERJ6GEYJ471V	RES,M 470-J-1/10W
R521	ERJ6GEYJ272V	RES,M 2.7K-J-1/10W
R531	**ERD25FJ470P**	**RES,C 47-J-1/4W**
R532	**ERJ6ENF1372V**	**RES,M 13.7K-F-1/10W**
R533	**ERJ6ENF1821V**	**RES,M 1.82K-F-1/10W**
R551	**ERDS1FJ1R0T**	**RES,C 1.0-J-1/2W**
R552	**ERDS1FJ1R0T**	**RES,C 1.0-J-1/2W**
R555	**ERDS1FJ101T**	**RES,C 100-J-1/2W**
R556	ERG1SJ221P	RES,M 220-J-1W
R557	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R558	**ERQ2CJP3R0S**	**RES,F 3.0-J-1/4W**
R559	ERG2FJ683H	RES,M 12K-J-2W
R562	ERG3FJ680H	RES,M 68-J-3W
R563	ERG1SJ150P	RES,M 15-J-1W
R567	ERG2FJ122H	RES,M 12K-J-2W
R572	ERJ6GEYJ222V	RES,M 2.2K-J-1/10W
R605	ERDS2TJ103T	RES,C 10K-J-1/4W

REPLACEMENT PARTS LIST

Models: CT-2022HBF, CT-2022HBCF.

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REF NO.	PART NO.	DESCRIPTION
R606	ERJ6GEYJ562V	RES,M 5.6K-J-1/10W
R607	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R608	ERJ6GEYJ104V	RES,M 100K-J-1/10W
R801	**ERF7ZK1R5**	**RES,W 1.5-K-7W**
R802	ERDS2TJ684T	RES,C 680K-J-1/4W
R803	ERG2FJ100H	RES,M 10K-J-1/2W
R804	ERG2FJ104H	RES,M 100K-J-2W
R805	**ERX2FZJR18H**	**RES,M .18-J-2W**
R806	**ERX2FJR56H**	**RES,M .56-J-2W**
R807	ERDS2TJ681T	RES,C 680-J-1/4W
R808	ERDS2TJ4R7T	RES,C 4.7-J-1/4W
R809	ERDS2TJ472T	RES,C 4.7K-J-1/4
R815	**ERC12ZGM825D**	**RES,S 8.2MEG-M-1/2**
R817	**ERX3FJ6R8**	**RES,M 6.8-J-3W**
R821	ERDS1FJ1R5T	RES,C 1.5-J-1/2W
R822	ERDS1FJ1R5T	RES,C 1.5-J-1/2W
R823	ERDS1FJ272T	RES,C 2.7K-J-1/2W
R824	ERDS2TJ223T	RES,C 22K-J-1/4W
R825	ERDS2TJ272T	RES,C 2.7K-J-1/4W
R828	ERJ6GEYJ104V	RES,M 100K-J-1/10W
R830	ERDS2TJ104T	RES,C 100K-J-1/4W
R831	ERDS2TJ682T	RES,C 6.8K-J-1/4W
R850	ERQ12HJR56P	RES,F .56-J-1/2W
R1001	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R1002	ERJ6GEYJ101V	RES,M 100-J-1/10W
R1003	ERJ6GEYJ101V	RES,M 100-J-1/10W
R1004	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R1005	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R1006	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R1007	ERDS2TJ102T	RES,C 1K-J-1/4W
R1008	ERJ6GEYJ102V	RES,M 1K-J-1/10W
R1010	ERDS2TJ472T	RES,C 4.7K-J-1/4
R1010	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R1011	ERDS2TJ103T	RES,C 10K-J-1/4W
R1012	ERDS2TJ104T	RES,C 100K-J-1/4W
R1013	ERDS2TJ103T	RES,C 10K-J-1/4W
R1015	ERDS2TJ105T	RES,C 1M-J-1/4W
R1017	ERDS2TJ681T	RES,C 680-J-1/4W
R1018	ERDS2TJ101T	RES,C 100-J-1/4W
R1019	ERDS2TJ101T	RES,C 100-J-1/4W
R1020	ERDS2TJ561T	RES,C 560-J-1/4W
R1021	ERDS2TJ103T	RES,C 10K-J-1/4W
R1022	ERDS2TJ101T	RES,C 100-J-1/4W
R1023	ERDS2TJ101T	RES,C 100-J-1/4W
R1028	ERDS2TJ103T	RES,C 10K-J-1/4W
R1029	ERDS2TJ103T	RES,C 10K-J-1/4W
R1030	ERDS2TJ103T	RES,C 10K-J-1/4W
R1031	ERDS2TJ103T	RES,C 10K-J-1/4W
R1032	ERDS2TJ103T	RES,C 10K-J-1/4W
R1033	ERDS2TJ104T	RES,C 100K-J-1/4W
R1034	ERDS2TJ103T	RES,C 10K-J-1/4W

REF NO.	PART NO.	DESCRIPTION
R1035	ERDS2TJ103T	RES,C 10K-J-1/4W
R1036	ERDS2TJ102T	RES,C 1K-J-1/4W
R1037	ERDS2TJ105T	RES,C 1M-J-1/4W
R2301	ERQ2CJP3R9S	RES,F 3.9-J-2W
R2307	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R2350	ERDS2TJ102T	RES,C 1K-J-1/4W
R2351	ERJ6GEYJ273V	RES,M 27K-J-1/10W
R2354	ERJ6GEYJ123V	RES,M 12K-J-1/10W
R2355	ERJ6GEYJ392V	RES,M 3.9K-J-1/10W
R2356	ERJ6GEYJ101V	RES,M 100-J-1/10W
R2357	ERJ6GEYJ472V	RES,M 4.7K-J-1/10W
R2365	ERDS2TJ102T	RES,C 1K-J-1/4W
R2370	ERJ6GEYJ103V	RES,M 10K-J-1/10W
R2401	ERJ6GEYJ225V	RES,M 2.2M-J-1/10W
R2405	ERJ6GEYJ153V	RES,M 15K-J-1/10W
R2406	ERJ6GEYJ243V	RES,M 24K-J-1/10W
R3001	ERDS2TJ101T	RES,C 100-J-1/4W
R3007	ERJ6GEYJ151V	RES,M 150-J-1/10W
R3008	ERJ6GEYJ151V	RES,M 150-J-1/10W
R3018	ERJ6GEYJ682V	RES,M 6.8K-J-1/10W
R3136	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R3137	ERJ6GEYJ223V	RES,M 22K-J-1/10W
R3138	ERJ6GEYJ153V	RES,M 15K-J-1/10W
R3139	ERJ6GEYJ333V	RES,M 33K-J-1/10W
R3140	ERJ6GEYJ154V	RES,M 150K-J-1/10W
	SWITCHES	
S001	EVQPF106K	SWITCH
S002	EVQPF106K	SWITCH
S003	EVQPF106K	SWITCH
S004	EVQPF106K	SWITCH
S005	EVQPF106K	SWITCH
S008	EVQPF106K	SWITCH
S009	EVQPF106K	SWITCH
	TRANSFORMERS	
T501	**ETH19Y211AZ**	**TRANSFORMER**
T551	**KFT3AA341F**	**TRANSFORMER, FLYBACK**
T801	**ETS29AS183NC**	**TRANSFORMER**
	CRYSTALS/FILTERS	
X001	TSSA092	CRYSTAL OSCILLATOR
X002	AF080005BE	CRYSTAL
	OTHERS	
TNR001	**ENG36604GR**	**TUNER**
M001	**TSX2AA0212-2**	**A/C LINE CORD**
M002	**A51JXS063X80**	**CRT**
M003	**TJSC00300**	**CRT SOCKET**
M004	0FMK014ZZ	CONVERGENCE CORRECTOR STRIP
M005	TMM2A30702	WEDGE, YOKE
DEG	**TSP2AA008A**	**COIL, DEGAUSSING**
M006	TXF3A011DB2	ASSY. DAG GROUND
M007	TXANV03ESER	DEG. COIL INST. KIT
M008	TSN63115-4	MAGNET, PURITY

REPLACEMENT PARTS LIST

Models: CT-2022HBF, CT-2022HBCF.

Important Safety Notice: Components printed in **BOLD TYPE** have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

REF NO.	PART NO.	DESCRIPTION
M009	TXFKU22ESER	ASSY, CABINET BACK (Cabinet back, rubber sheet, overlay model nameplate, 4 model nameplate, felt, instructions sheet labels, 3 label X-ray warning french, label X-ray warning spanish, label bbe patent, 3 label X-ray warning)
M010	TXFKY33ESER	ASSY, CABINET FRONT (Cabinet front, badge PANASONIC, smoked sheet, guide ir, label service information reference)
M011	TAS2AA0012	SPEAKER 16-OHM 1.5W
M012	TBM2A10141	BADGE, PANASONIC
M013	TKX2A3753	GUIDE, IR
M014	TBX2AA00601G	BUTTON, 7-KEY
JK1001	TJB2AX0021	MODULAR JACK
JK3002	TJB2AA0034	TERMINAL, FRONT A/V
	ACCESSORIES	
M015	EUR501450	REMOTE CONTROL
M016	UR50EC1190A	BATTERY COVER REMOTE CONTROL
M017	TQB2AA0387-2	MANUAL, OWNERS
M018	TQB2AA7057	REMOTE GUIDE
M019	TQB2AA7108	V-CHIP MANUAL

Description of abbreviations guide

RESISTOR

TYPE		TOLERANCE	
C	Carbon	F	± 1%
F	Fuse	J	± 5%
M	Metal Oxide	K	± 10%
S	Solid	M	± 20%
W	Wire Wound	G	± 2%

RES, C 270-J-1/4

CAPACITOR

TYPE		TOLERANCE	
C	Ceramic	C	± 0.25pF
E	Electrolytic	D	± 0.5pF
P	Polyester	F	± 1pF
S	Styrol	J	± 5%
T	Tantalum	K	± 10%
		L	± 15%
		M	± 20%
		P	+10% -0%
		Z	+80% -20%

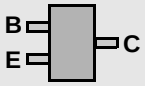
CAP, P .068UF-K-50V

Notes:

IMPORTANT SAFETY NOTICE

THIS SCHEMATIC DIAGRAM INCORPORATES SPECIAL FEATURES THAT ARE IMPORTANT FOR PROTECTION FROM X-RADIATION, FIRE AND ELECTRICAL SHOCK HAZARDS. WHEN SERVICING IT IS ESSENTIAL THAT ONLY MANUFACTURERS SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS DESIGNATED WITH A ⚠ IN THE SCHEMATIC.

CHIP TRANSISTOR LEAD DESIGNATION



SCHEMATIC NOTES

1. Resistors are carbon 1/4W unless noted otherwise.
2. Capacitors are ceramic 50V unless noted otherwise.
3. Coil value notes is inductance in μH.
4. Test point indicated by ; Test point but no pin .
5. Components indicated with ⚠ are critical parts and replacement should be made with manufacture specified replacement parts only.
6. (**BOLD LINE**) indicates the route of B+ supply.
7. The schematic diagrams are current at the time of printing and are subject to change without notice.
8. Ground symbol indicates **HOT GROUND CONNECTION**; indicates COLD GROUND.

NOTE: All other component symbols are used for engineering design purposes.

VOLTAGE MEASUREMENTS

1. Voltage measurement:
   - AC input to the Receiver is 120V. NTSC (HD, 1125i & 525P when applicable) signal generator is connected to the antenna of the Receiver. (Color bar pattern of 100 IRE white and 7.5 IRE black.)
   - All Picture and Audio adjustments are set to Normalize.
     TV ANT/CABLE - (Set-Up Menu) in TV/ANT Mode
     Volume - Min.
     TV/Video SW - TV position
     Audio Mode - Stereo
   - Voltage readings are nominal and may vary ±10% on active devices. Some voltage reading will vary with signal strength and picture content.
   - Supply voltages are nominal.
2. Ground symbol indicates ground lead connection of meter.
   Incorrect ground connection will result in erroneous readings.

CAUTION: ***Incorrect ground connection of the test equipment will result in erroneous readings.***

WAVEFORM MEASUREMENTS

1. ③ indicates waveform measurement. (Measurement can be taken at the best accessible location in common to the indicated point.)
2. Taken with an NTSC signal generator connected to the antenna terminal. (NTSC color bar pattern of 8 bars of EIA colors, 100 IRE white and 7.5 IRE black.)
3. Customer Controls (Picture/Audio Menu) are set to Normalize. Volume is set to “MIN”.
4. All video and color waveforms are taken with a wideband scope and a probe with low capacitance (10 to 1). Shape and peak altitudes may vary depending on the type of Oscilloscope used and its settings.
5. Ground symbol shown on waveform number indicates (Hot) ground lead connection of the Oscilloscope.

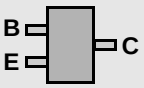
CAUTION: Incorrect ground connection of the test equipment will result in erroneous readings.

Notas

NOTA DE SEGURIDAD

LOS DIAGRAMAS ELÉCTRICOS INCLUYEN CARACTERÍSTICAS ESPECIALES MUY IMPORTANTES PARA LA PROTECCIÓN CONTRA RAYOS-X, QUEMADURAS Y DESCARGAS ELÉCTRICAS. CUANDO SE DE SERVICIO ES IMPORTANTE USAR PARA REEMPLAZO DE COMPONENTES CRITICOS, SOLO PARTES ESPECIFICADAS POR EL FABRICANTES. LOS COMPONENTES CRITICOS ESTAN SEÑALADOS EN LOS DIAGRAMAS POR EL SIMBOLO ⚠.

IDENTIFICACIÓN DE TERMINALES PARA TRANSISTORES EN *CHIP*



NOTAS DE LOS DIAGRAMAS

1. Las Resistencias son de Carbón de 1/4W, a menos que se indique otra característica.
2. Los Capacitores son de Cerámica para 50V, a menos que se indique otra característica.
3. El valor indicado de las Bobinas es la inductancia expresada en μH.
4. Los puntos de prueba en la terminal de algún componente son indicados por ● Los puntos de prueba fuera de los componentes se indican con ○.
5. Los componentes señalados con el símbolo ⚠ son considerados componentes críticos y deben ser reemplazados sólo con las partes especificadas por el fabricante.
6. ▬ (**LINEA GRUESA**) indica las líneas de alimentación de los Voltajes B+.
7. Los diagramas eléctricos están sujetos a cambio sin previo aviso.
8. El símbolo ⏚ indica que es una conexión a **Tierra Caliente** y el símbolo ⏚ indica conexión a **Tierra Fría**.

NOTA: Los demas símbolos de componentes incluidos son usados con fines de diseño.

MEDICIÓN DE VOLTAJES

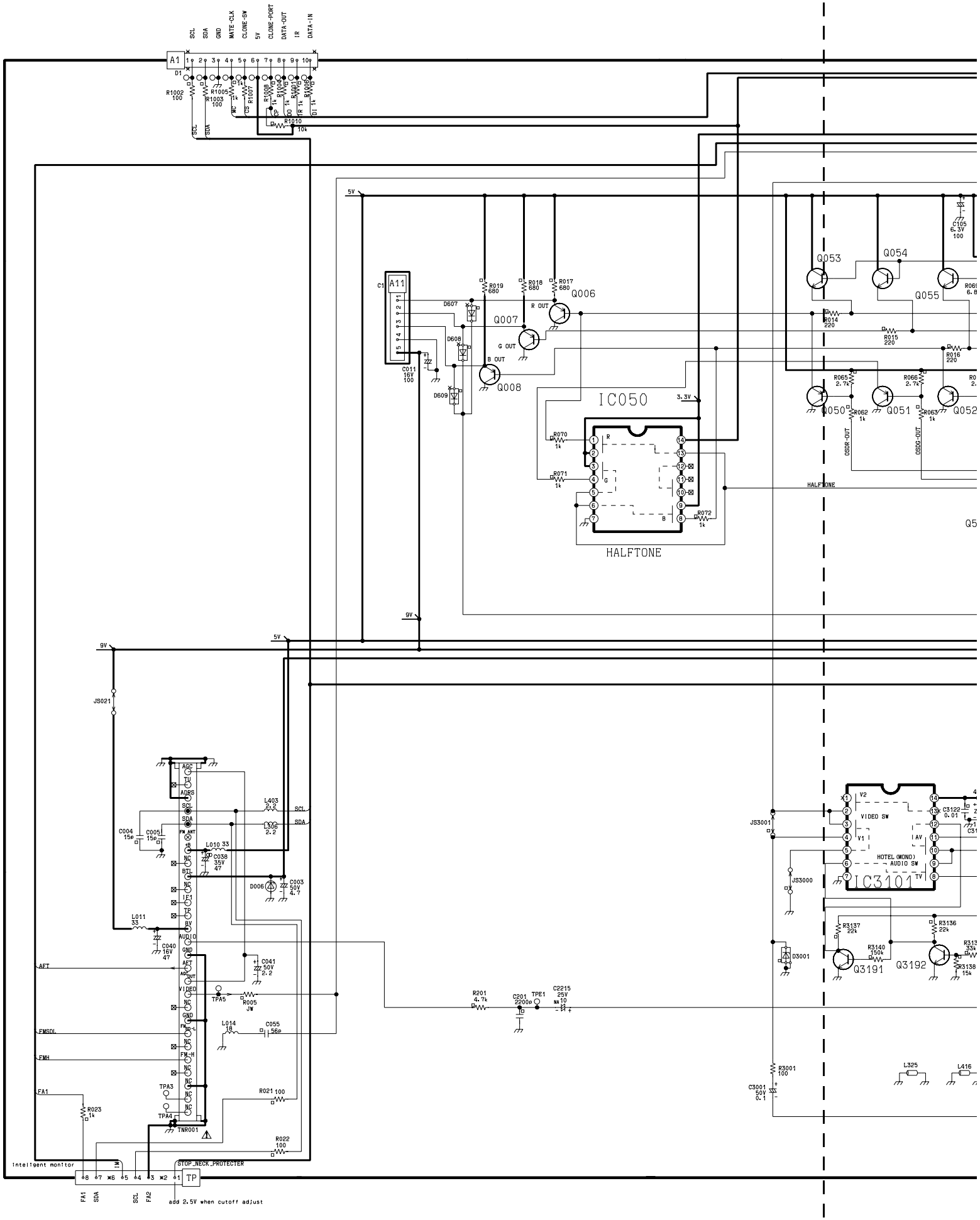
1. Medición de voltaje:
   - El voltaje de entrada al Receptor es de 120V de Corriente Alterna. Un generador de patrones con formato NTSC se conecta a la entrada de la antena. (Patrón de Barras de Colores con 100 IREs para el Blanco y 7.5 IREs para el Negro.)
   - Los ajustes de los Menus Picture y Audio se normalizan.
     En el Menú Set-Up, en la opción ANTENA, se selecciona el modo de CABLE.
     El nivel de Volumen se minimiza.
     De los modos TV y Video, seleccionar el modo TV.
     Seleccionar modo Estereo del Audio.
   - Las mediciones de los voltajes son nominales y pueden variar hasta 10% en componentes en funcionamiento. Las lecturas de los voltajes pueden variar por la potencia de la señal y el contenido de la imagen.
   - Las fuentes de voltajes son nominales.
2. El símbolo ⏚ indica el tipo de tierra que se utiliza en la conexión del medidor.

PRECAUCION: SI no se utiliza la conexión a la tierra adecuada, se obtendrán mediciones equivocadas y podría dañar el equipo de medición.

MEDICIÓN DE FORMAS DE ONDA

1. Un símbolo como ③ indica el punto para medir una señal. (La medición puede hacerse en el punto con mayor accesibilidad, siempre que sea común al indicado.)
2. Se midieron utilizando un generador con formato NTSC conectado a la terminal de la antena. (Patrón de 8 Barras de Colores EAI, formato NTSC de 100 IREs para el Blanco y 7.5 IREs para el Negro.)
3. Los ajustes de usuario de los Menus PICTURE y AUDIO se normalizaron. Posteriormente el nivel de volumen se ajusta al mínimo.
4. Las formas de onda de Video y Color fueron tomadas con un osciloscopio de banda alta y con un punta de prueba de baja capacitancia (10 a 1). La forma y amplitud de las ondas puede variar según el tipo de osciloscopio que se utilice y sus características.
5. El símbolo de tierra ⏚ que aparece junto al número de la forma de onda, indica que se utiliza conexión a **Tierra Caliente** en el extremo negativo de la punta de prueba.

PRECAUCION: Si no se utiliza la conexión a la tierra adecuada, se obtendrán mediciones equivocadas y podría dañar el equipo de medición.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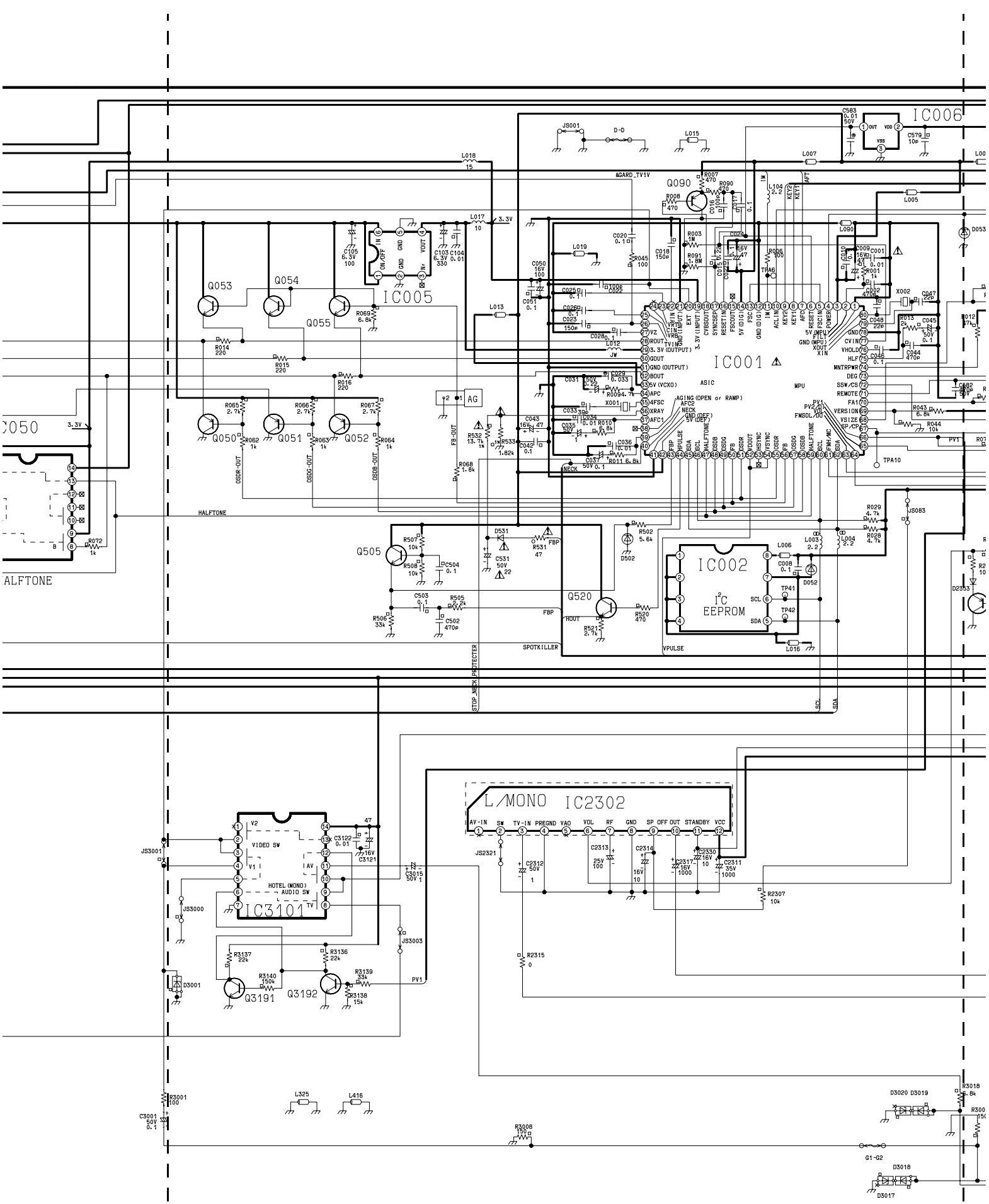
SCL
SDA
GND
MATE-CLK
CLONE-SW
5V
CLONE-PORT
DATA-OUT
IR
DATA-IN
R1002 100
R1005 100
R1003 100
R1007 1k
R1008 1k
R1001 1k
R1004 1k
R1006 1k
R1010 10k
A11
R019 680
R018 680
R017 680
Q006
Q007
Q008
R OUT
G OUT
B OUT
D607
D608
D609
C011 16V 100
IC050
R070 1k
R071 1k
R072 1k
HALFTONE
3.3V
9V
5V
Q053
Q054
Q055
Q050
Q051
Q052
R014 220
R015 220
R016 220
R065 2.7k
R066 2.7k
R062 1k
R063 1k
DSDR-OUT
DSDG-OUT
C105 6.3V 100
JS021
L403 2.2
L402 2.2
C004 15p
C005 15p
L010 33
C038 35V 47
D006
C003 50V 4.7
L011 33
C040 16V 47
C041 50V 2.2
AFT
VIDEO
TPA5
R005 0
L014 18
C055 56p
FMSDL
FMH
FA1
TPA3
TPA4
R023 1k
R021 100
R022 100
TNR001
R201 4.7k
C201 2200p
TPE1
C2215 25V 10
JS3001
JS3000
D3001
IC3101
V2
VIDEO SW
V1
AV
HOTEL (MONO)
AUDIO SW
TV
C3122 0.01
R3137 22k
R3136 22k
R3140 150k
Q3191
Q3192
R3138 15k
R3001 100
C3001 50V 0.1
L325
L416
intelligent monitor
STOP_NECK_PROTECTER
TP
add 2.5V when cutoff adjust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IC002
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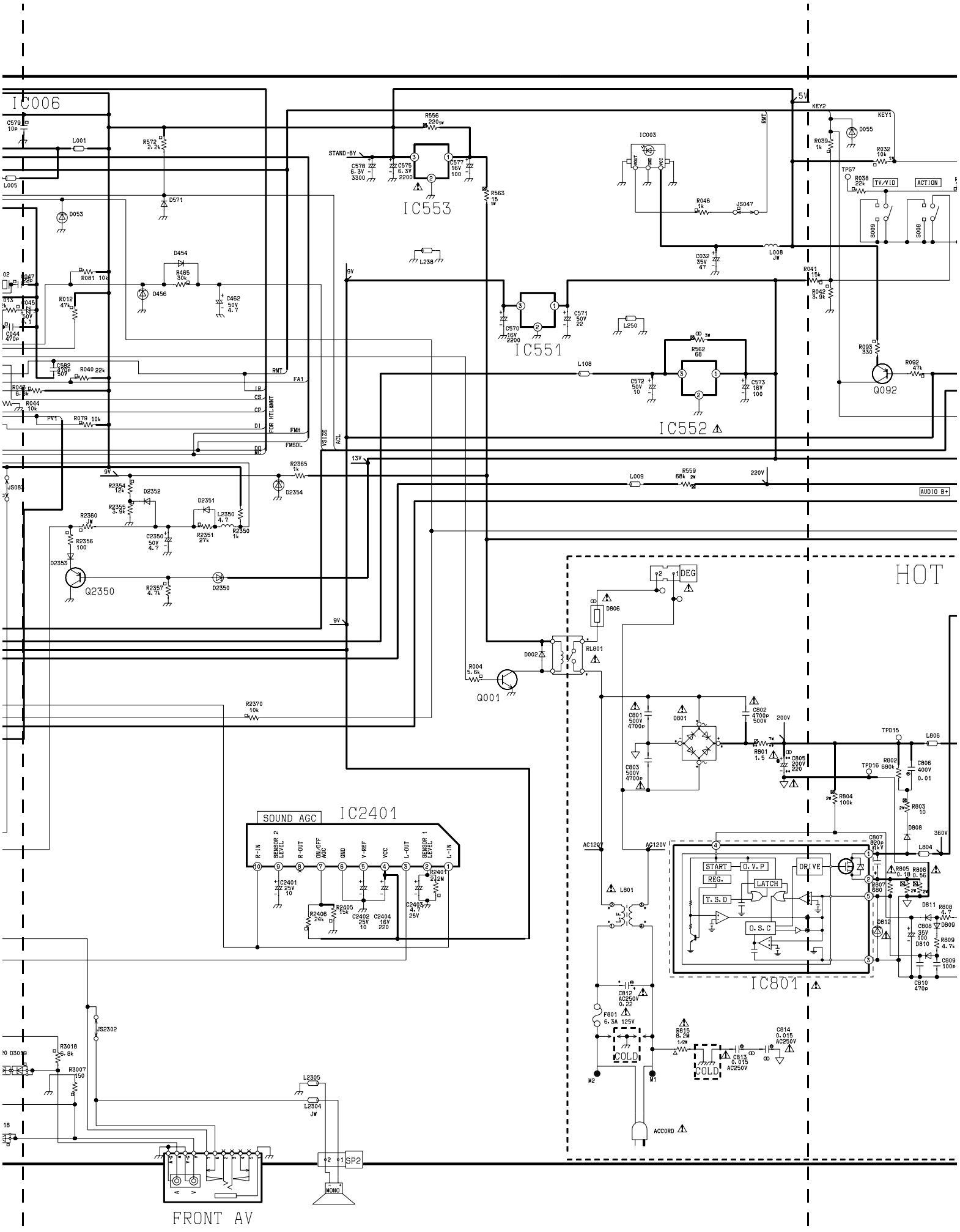
Q053
Q054
Q055
Q050
Q051
Q052
Q505
Q520
Q3191
Q3192
L/MONO
EEPROM
ASIC
MPU
HALFTONE
SPOTKILLER
STOP_NECK PROTECTER
VPULSE
FBP
HOUT
NECK
AG
3.3V
JS3001
JS3000
JS3003
JS2321
JS083
TPA10
TPA6
D-D
&GARD_TV1V

A-Board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IC553
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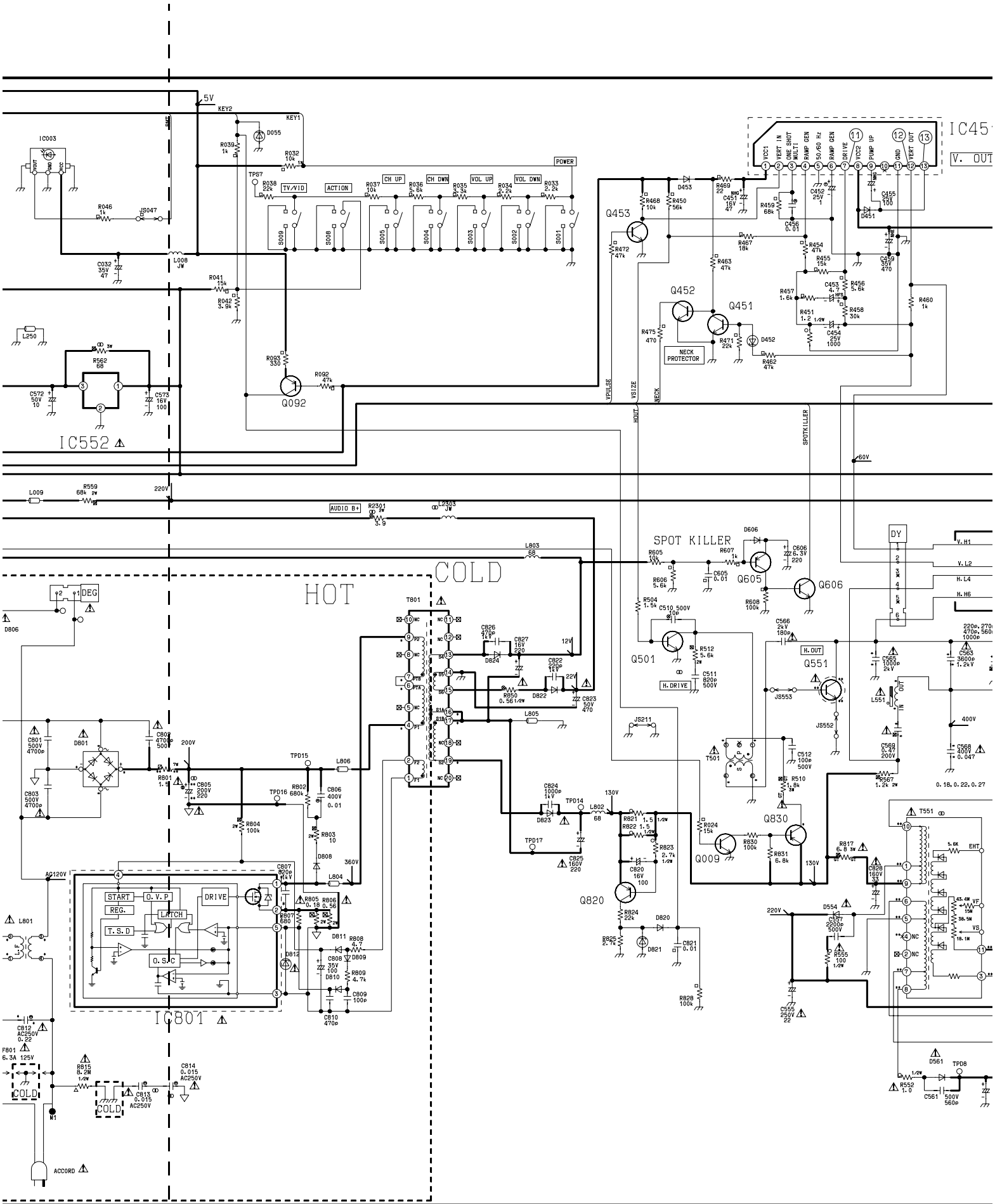
IC552
IC003
IC2401
IC801
HOT
SOUND AGC
FRONT AV
STAND-BY
5V
9V
13V
220V
AUDIO B+
KEY2
KEY1
RMT
TV/VID
ACTION
DEG
START
O.V.P
REG.
LATCH
DRIVE
T.S.D
O.S.C
COLD
ACCORD
MONO
SP2
Q2350
Q001
Q092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KEY2
KEY1
D055
POWER
TV/VID
ACTION
CH UP
CH DWN
VOL UP
VOL DWN
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Q452
Q451
NECK PROTECTOR
SPOT KILLER
Q605
Q606
Q501
Q551
Q830
Q009
Q820
H. DRIVE
H. OUT
AUDIO B+
220V
60V
COLD
HOT
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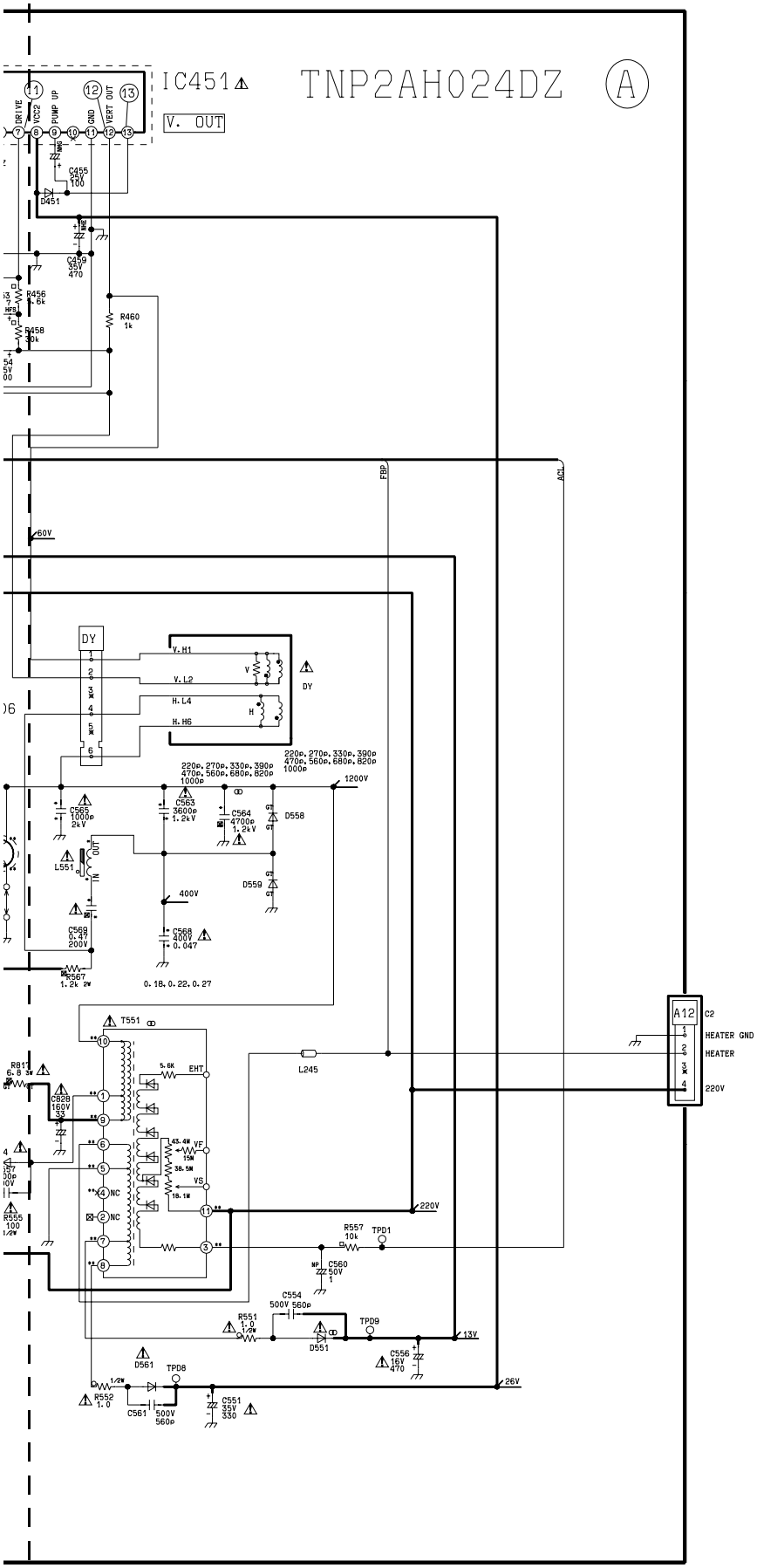
REG.
LATCH
T.S.D
O.S.C
DRIVE
ACCORD
DY

A-Board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V. OUT
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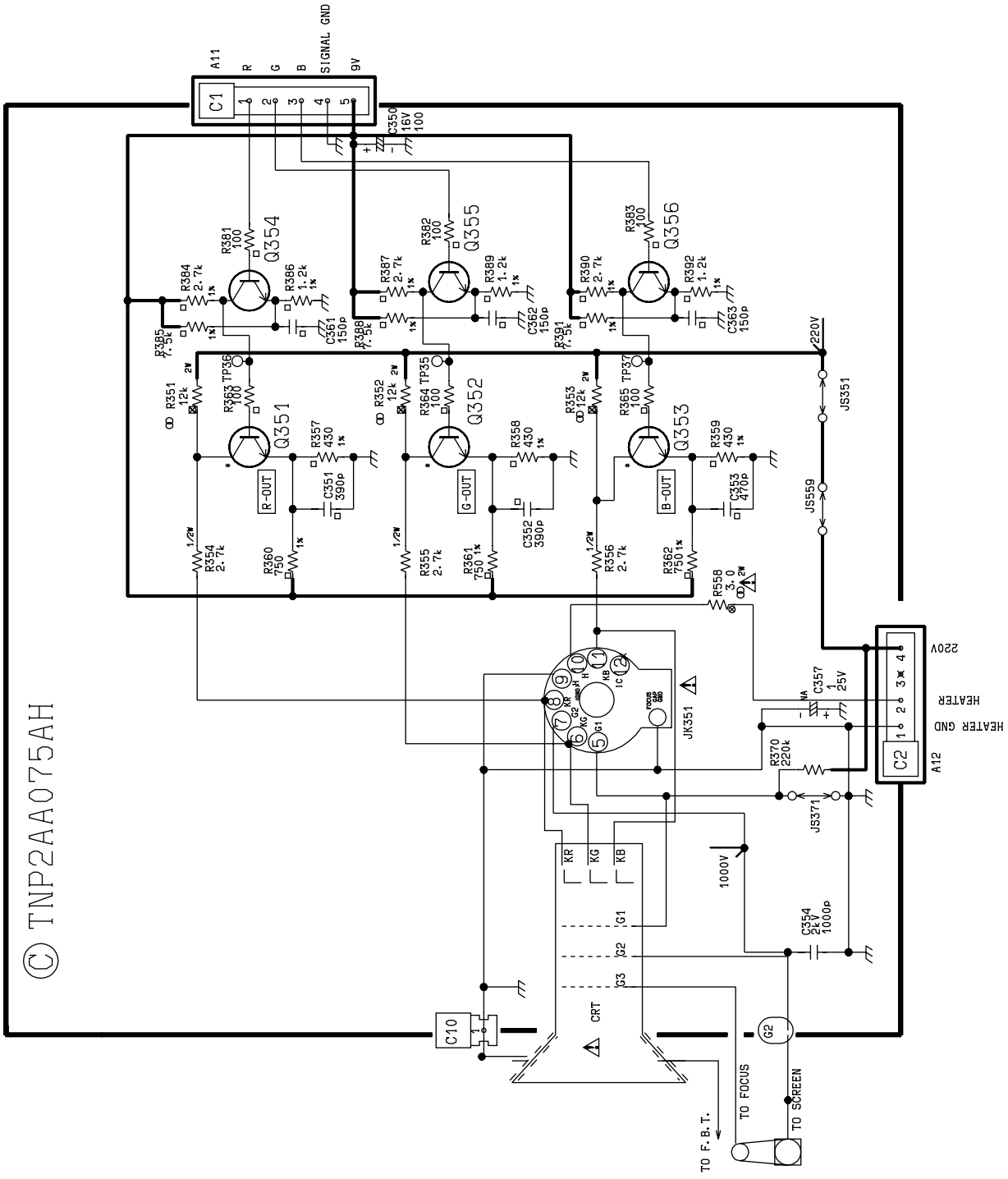
PUMP UP
GND
VERT OUT
C455 35V 100
D451
C459 35V 470
R456 6.6k
R458 30k
R460 1k
FBP
ACL
60V
DY
V. H1
V. L2
H. L4
H. H6
V
H
220p. 270p. 330p. 390p 470p. 560p. 680p. 820p 1000p
1200V
C565 1000p 2kV
C563 3600p 1.2kV
C564 4700p 1.2kV
D558
D559
L551
OUT
IN
400V
C568 400V 0.047
C569 0.47 200V
R567 1.2k 2W
0. 18. 0. 22. 0. 27
T551
5.6K
EHT
43.4M 1W
VF
38.5M
VS
18.1M
NC
NC
220V
L245
A12
C2
HEATER GND
HEATER
220V
R557 10k
TPD1
C560 50V 1
C554 500V 560p
R551 1.0 1/2W
TPD9
D551
13V
C556 16V 470
D561
TPD8
R552 1.0
C561 500V 560p
C551 35V 330
26V


© TNP2AA075AH
A11
R
G
B
SIGNAL GND
9V
C1
C350 16V 100
Q354
Q355
Q356
Q351
Q352
Q353
R381 100
R382 100
R383 100
R384 2.7k
R386 1.2k
R387 2.7k
R389 1.2k
R390 2.7k
R392 1.2k
R385 7.5k
R388 7.5k
R391 7.5k
C361 150p
C362 150p
C363 150p
R351 12k
R352 12k
R353 12k
R363 100
R364 100
R365 100
R357 430
R358 430
R359 430
C351 390p
C352 390p
C353 470p
R354 2.7k
R355 2.7k
R356 2.7k
R360 750
R361 750
R362 750
R558 3.0
R-OUT
G-OUT
B-OUT
220V
JS351
JS559
JS371
JK351
R370 220k
C357 1 25V
C354 2kV 1000p
1000V
HEATER
HEATER GND
A12
C2
C10
CRT
G1
G2
G3
KR
KG
KB
TO FOCUS
TO SCREEN
TO F.B.T.

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